Factors That Affect VMT Growth

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For years, forecasters have thought that annual vehicle miles of travel ("VMT") growth would begin to drop below earlier rates. These forecasters cited vehicle saturation and time constraints behind the wheel as reasons why VMT growth rates would decline and eventually come closer to the rate of population growth.

But VMT growth has exceeded government projections over the last 15 years. What are the factors that affect VMT growth? What is happening to these factors? These are the two questions addressed in this paper.

Because VMT growth has proven to be robust and because high VMT growth drives up vehicle oil use, what federal actions can be taken to slow the rate of growth?

This paper begins with an introduction discussing past VMT growth rates. Section 2 provides a discussion of factors affecting VMT growth including population growth, aging of the population, regional population switches, VMT by gender, age, and race, vehicle trip length, cost of driving, and alternatives to driving. Section 3 discusses federal efforts that affect VMT growth. And the paper finishes with a discussion of the impacts of VMT growth on transportation energy use.

SECTION 1: INTRODUCTION

Since 1970, vehicle miles traveled (VMT) has increased at a rate of over 3% per year as shown in Table 1. Though the average increase in VMT was over 3% per year, there was great variation in VMT growth during the period. Many analysts attribute VMT growth in the past twenty years to increased female participation in the workforce. Analysts expect the rate of increase in VMT in the future to be lower (about 1.5% to 2.0% per year) because of the aging of the population (Table 2).

Table 1: Historic Annual Growth Rates for VMT, Population, and GDP (current $)

Interval	VMT (% per year)	Population (% per year)	GDP (% per year)
1970 to 75	3.65%	1.10%	2.62%
1975 to 80	2.84%	1.07%	2.12%
1980 to 85	3.04%	0.92%	2.91%
1985 to 90	3.86%	0.94%	2.46%
1990 to 95	2.47%	1.05%	1.66%
Trend (1970-95)	3.17%	1.02%	2.35%

Source: Stacy C. Davis, Oak Ridge National Laboratory, Transportation Energy Databook: Edition 17, ORNL-6919, August 1997; U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, April 1997.

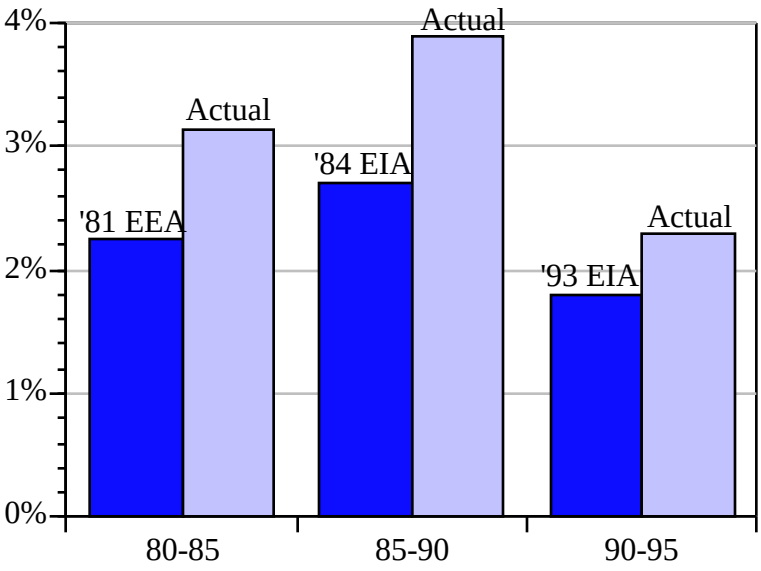
Table 2: Projected Growth Rates for VMT (~1995 to ~2015)

Source	Projected Growth Rate
EIA/AEO 95	1.8%
EIA/AEO 96	1.4%
EIA/AEO 97	1.4%
EIA/AEO 98	1.5%
DOT/FHWA (5/96)	2.2%
Cartalk	~1.9%

Source: U.S. Department of Energy, Energy Information Agency, Annual Energy Outlook, 1995-1998 Editions; U.S. Department of Transportation, Federal Highway Administration, "Budget for FY98;" Input to the "Policy Dialogue Advisory Committee to Develop Options for Reducing Greenhouse Gas Emissions from Personal Motor Vehicles," 1995.

As illustrated by figure 1, past projections by EEA (before EIA made projections) and EIA have underestimated VMT growth. These projections obviously did not take into account the impact of factors that pushed VMT higher than expected.

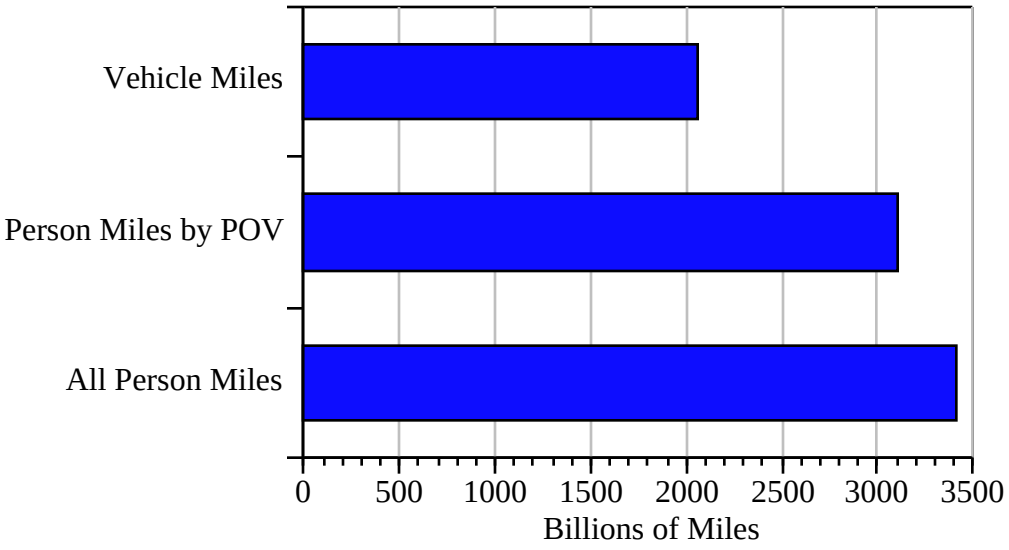
Figure 1: Actual v. Estimated VMT Growth Rates



Source: John German, EPA, "Factors Affecting VMT Growth," March 17, 1997.

A key concept to understanding VMT, is the relationship of VMT to person-miles of travel. VMT is the level of travel of vehicles, while person miles is the level of travel of people. Figure 2 illustrates that nearly 90% of all personal travel is done in highway vehicles (compare person miles by privately owned vehicles ("POV") to all person miles). Vehicle miles is a subset of person miles by POV. The difference between vehicle miles and person miles by POV is accounted by the number of occupants in the vehicle (See the section on occupancy later).

Figure 2: Total Travel in 1995



Source: U.S. Department of Transportation, National Personal Transportation Study (NPTS) 1995, 1997 (available at http://www-cta.ornl.gov/npts/1995/doc/index.html.ssi).

Section 2: Factors Affecting VMT Growth

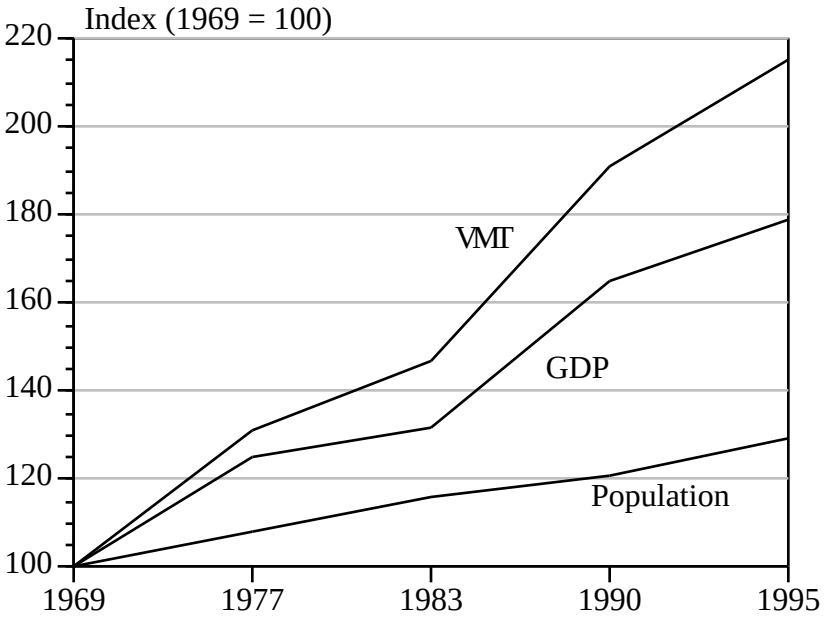
Figure 3 shows the major factors affecting VMT. Graphs showing trends that have a positive effect on VMT growth have a plus sign above them. Note that all the signs are pluses except for the aging population factor. These graphs will show why VMT has more than doubled between 1970 and 1995.

FIGURE 3 CAN’T BE VIEWED AS A PDF.

2.1. POPULATION AND ECONOMIC ACTIVITY

Population growth and economic activity play a key role in VMT growth. Figure 4 shows that VMT grew faster than both GDP and population between 1970 and 1995.

Figure 4: Changes in Population, VMT, and GDP

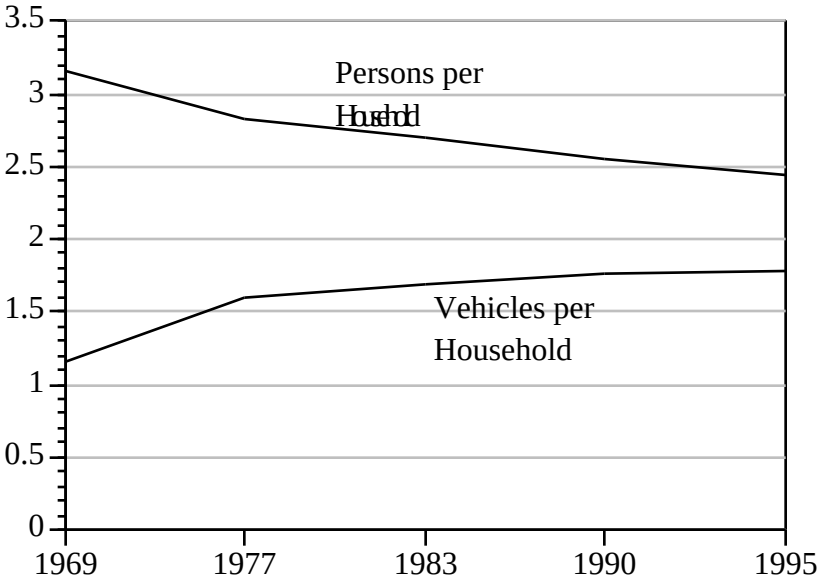


Source: U.S. Department of Transportation, National Personal Transportation Study (NPTS) 1995, 1997 (available at http://www-cta.ornl.gov/npts/1995/doc/index.html.ssi).

2.2 VEHICLE OWNERSHIP

Figure 5 shows that while persons per household has been steadily declining, vehicles per household has been increasing. These changes have been happening as the number of households has continued to rise from 63 million in 1970 to 98 million in 1995.

Figure 5: Changes in Rates



Source: U.S. Department of Transportation, National Personal Transportation Study (NPTS) 1995, 1997 (available at http://www-cta.ornl.gov/npts/1995/doc/index.html.ssi).

2.3 REGIONAL POPULATION SHIFTS

Another reason given for VMT growth has been shifts in population from regions with lower VMT per vehicle to regions with higher VMT per vehicle. Between 1960 and 1995, the West and South gained 8.8 percentage points in the overall share of US population as shown in Table 3. Vehicles in the South and West, collectively, travel about 471 miles per year than vehicles in the Northeast and Midwest.

Table 3: U.S. Population by Region (Percent)

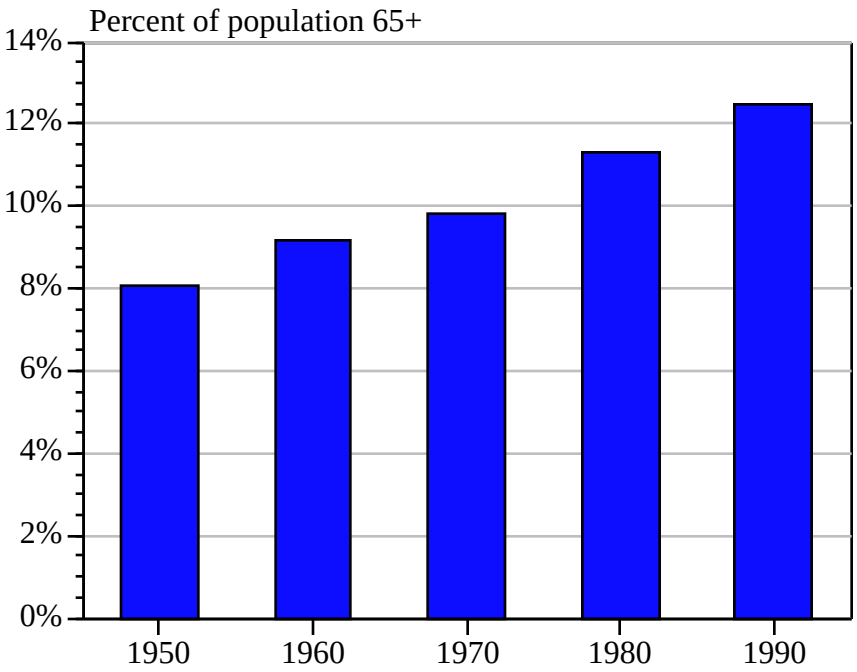
	1960	1995	VMT/Vehicle (1995)
Northeast and Midwest	51.9%	43.1%	11,952
South and West	48.1%	56.9%	12,423
Net to South and West		8.8%	471

Source: Bureau of the Census, press release CB96-10.

2.4 AGING OF THE POPULATION

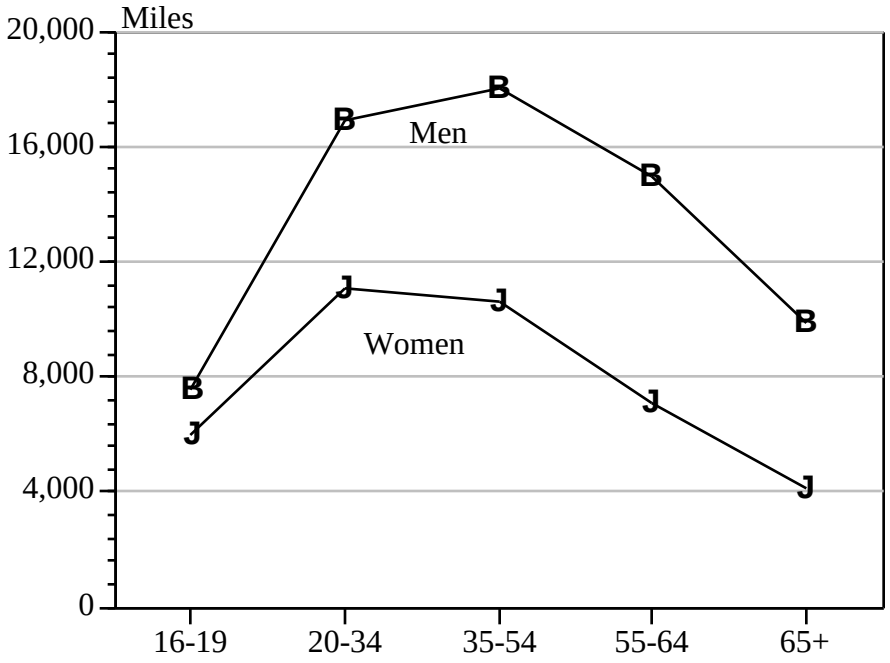
A key factor that could plays a role in dampening VMT growth is the aging of the population. Figure 6 shows that the percent of residents over 65 grew from about 8% in 1950 to about 12% in 1990. An aging population reduces VMT growth because older people tend to drive less. Figure 7 shows that people 65 and over drove nearly 40% less than people 35-54. It also shows a large gap between male and female VMT. As women's labor participation rates begin to equal men's, this gap probably will become smaller. These numbers are offset, however, by the fact that there is a trend for age groups to drive more over time. Figure 8 shows this by showing how VMT per driver by age group has risen between 1969 and 1995.

Figure 6: Percent of Population Over 65+



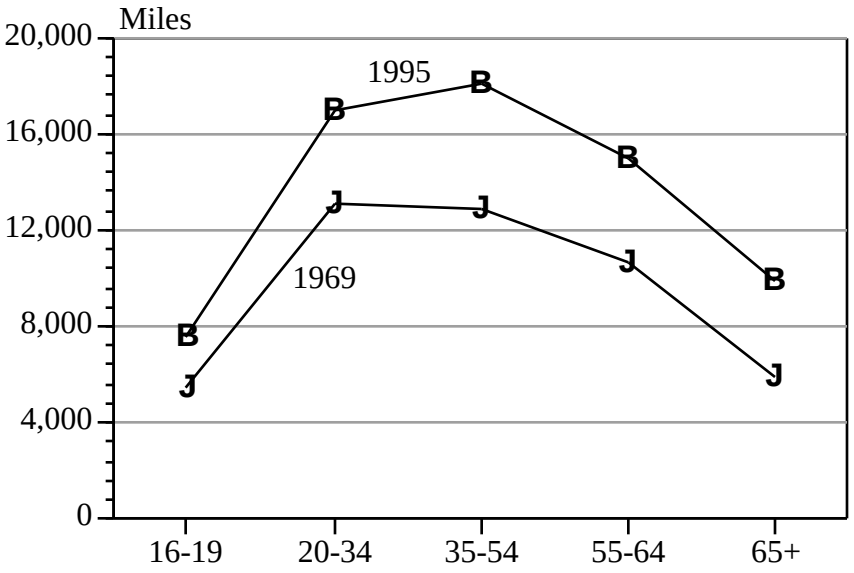
Source: Census Bureau, "65+ in the United States," P23-190, April 1996, p. 2-3.

Figure 7: Annual VMT by Gender and Age in 1995



Source: U.S. Department of Transportation, National Personal Transportation Study (NPTS) 1995, 1997 (available at http://www-cta.ornl.gov/npts/1995/doc/index.html.ssi).

Figure 8: Comparison of Men's Annual VMT in 1969 and 1995



Source: U.S. Department of Transportation, NPTS 1995.

2.5 TRIP LENGTH

Table 4 shows the average work trip length for three periods. This distance has grown 36.5% between 1983 and 1995. In only twelve years, this distance has grown by a third! Note that the travel time for work trips grew only 14% during the same period. The reason why the time growth increase was so much less than the distance growth increase is that work trip speeds grew 20%.

Table 4: Commute Profile

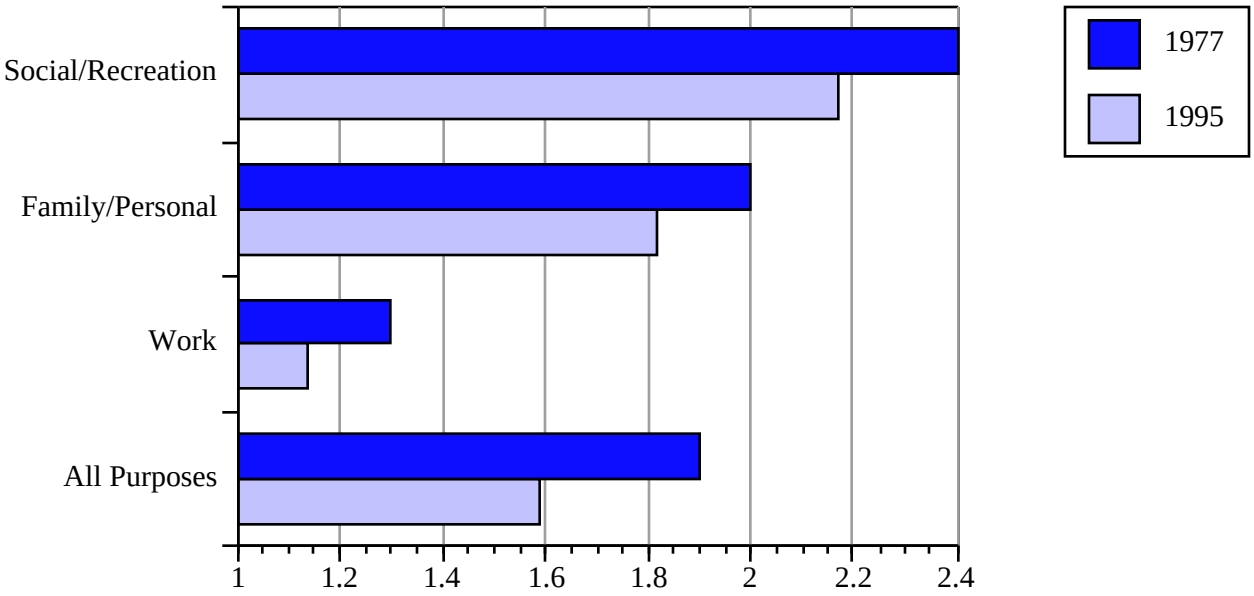
	1983	1990	1995	'83 to '95 % Change
Average Work Trip Length (Miles)	8.5	10.6	11.6	36.5
Average Work Travel Time (Minutes)	18.2	19.7	20.7	13.7
Average Work Trip Speed (MPH)	28	32.3	33.6	20

Source: U.S. Department of Transportation, NPTS 1995.

2.6 OCCUPANCY

In 1995, the average vehicle occupancy rate was 1.59. Occupancy rates, however, vary dramatically by trip purpose. For example, the occupancy rate for work trips was about 1.1, while the rate for social trips was nearly 2.2. Figure 9 shows that occupancy has declined since 1977 for all trip categories.

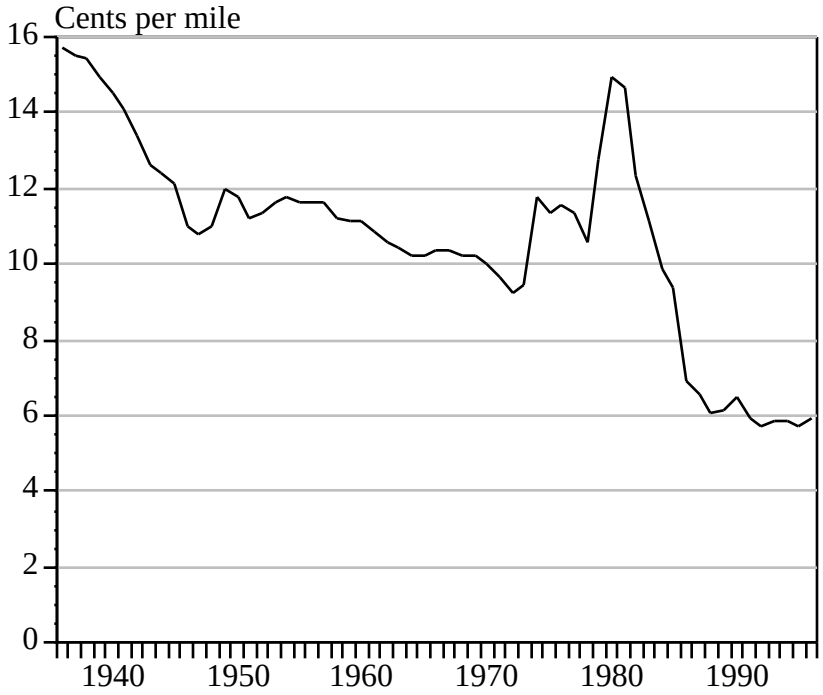
Figure 9: Vehicle Occupancy by Purpose



2.7 COST OF DRIVING

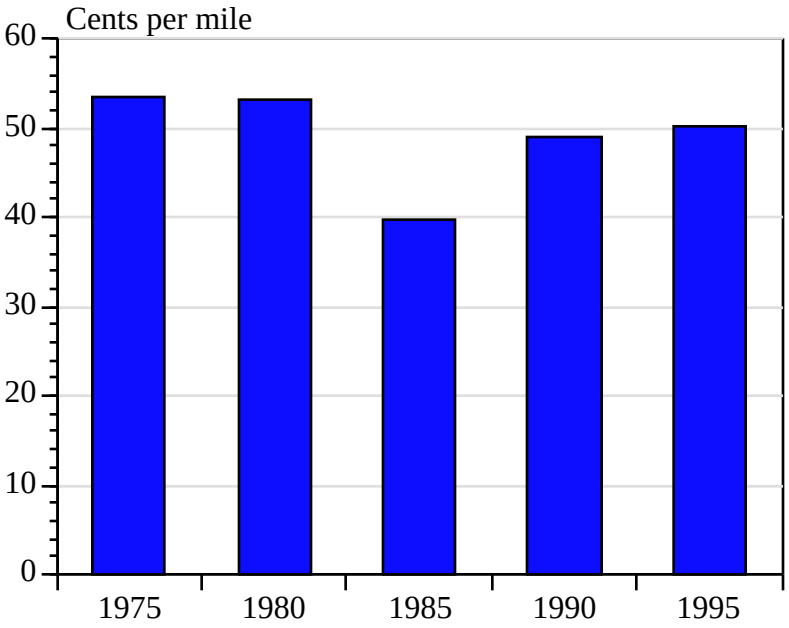
A number of models rely on the cost of driving as a key component of VMT growth. Figure 10 illustrates the fuel cost of driving over the last sixty years. The fuel cost of driving is currently at its lowest level today. Of course, fuel costs are not the main costs of driving a vehicle even though it is the single most considered factor in drivers's decisions to travel more or less. Figure 11 shows that the trend in total costs has not shown much of a change in the past twenty years.

Figure 10: Fuel Cost of Driving a Mile, 1936 to 1996 (1996 Dollars)



Source: Gasoline costs were divided by on-road vehicle fuel economy. Data for gasoline costs: 1936-1946 = API; 1947-1948 = extrapolation; 1949-1996 = EIA. Prices were for leaded gasoline from 1936 to 1975 and unleaded gasoline thereafter. Fuel economy data: 1936-1959 = Highway Statistics, DOT/FHA; 1960-1996 = EIA.

Figure 11: Total Costs of Driving a Mile, 1975 to 1995

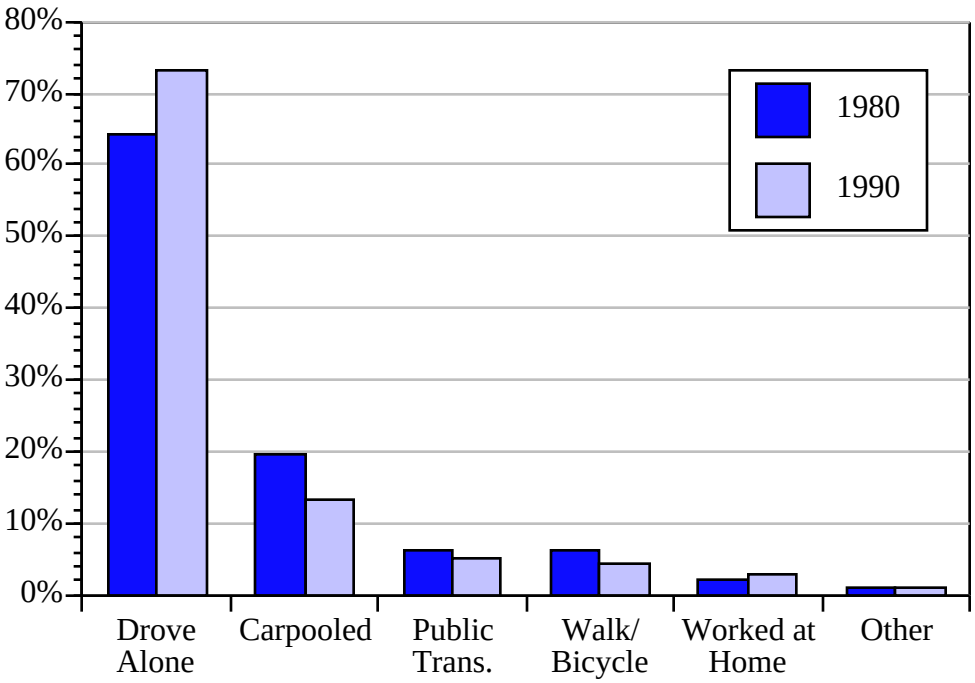


Source: Stacy C. Davis, Oak Ridge National Laboratory, Transportation Energy Databook: Edition 17, ORNL-6919, August 1997.

2.8 ALTERNATIVES

Travel by non-motorized forms of transportation and mass transit have been declining in the past two decades as reliance on single occupancy use of vehicles has been increasing. As shown in Figure 12, the share of workers driving alone has increased from 64% in 1980 to 73% in 1990, while the share of commuters using mass transit has declined from 6.4% to 5.3% and the share of walkers/bikers has declined from 6.1% to 4.3%.

Figure 12: Means of Transportation to Work, 1980 and 1990



Source: Stacy C. Davis, Oak Ridge National Laboratory, Transportation Energy Databook: Edition 17, ORNL-6919, August 1997.

2.8.1 *Carpooling*

Carpooling has declined in share of travel in spite of growth in high-occupancy vehicle ("HOV") lanes and other carpool incentives. The Texas Transportation Institute reports that the number of miles of HOV lanes has grown from 10 miles in 1970 to 540 miles in 1994.

2.8.2 Mass Transit

Mass transit has played a decreasing role in the US over time as the nation has become more spread out and household vehicle ownership has increased. Cheap fuel prices and suburban growth led to a long period of transit decline from the late 1940s to early 1970s. Mass transit is still declining today as a percent of overall travel, despite substantial federal, local, and state commitment to transit infrastructure.

2.8.3 Bicycling and Walking

The 1995 NPTS estimated that bicycling accounted for 4.6 billion PMT and walking accounted for 10.8 billion PMT. While bicycling and walking combined accounted for 0.4% of total PMT, bicycling accounted for 0.9% of all person trips and walking accounted 5.4 of all person trips. The average bicycle trip length was 1.4 miles and the average walking trip length was 0.5 miles.

2.8.4 Work at Home

One growing component of the work at home phenomena is telecommuting. Telecommuting and teleshopping provide good opportunities to reduce VMT by meeting people's transportation needs without requiring any physical movement. The 1995 American Housing Survey estimated that 11

million workers perform some "regularly-scheduled work for their employers at home." The study found that 4.8 million workers had worked at home in the week prior to the survey. This number is up dramatically from a US DOT estimate of nearly 2 million in 1993. Though, telecommuting has large potential benefits, it is unknown how many trips employees make when they are working at home. In addition, telecommuting might stimulate urban sprawl.

Another big factor is the growth of the internet. Internet use in the U.S. has grown dramatically from 5.6 million users in 1995 to 21 million users in 1997 (See http://aspirix.com -- estimates made by the company "e-land"). Business Week magazine estimated that there were 40 million internet users worldwide in the middle of 1997. The internet has the potential to dramatically alter the way Americans conduct business, shop, and interact with each other. Table 5 summarizes a number of indicators of the level of internet commerce.

Table 5: Measures of Electronic Commerce and "Travel" in 1997

Indicator	Metric
Number of U.S. Internet Users	21 million
Number of Worldwide Internet Users	40 million
Dell Computer Internet Sales	$3 million per day
Microsoft Expedia Travel Service Sales	$2 million per week
Amazon Book Internet Customers	> 1 million
Auto-by-Tel Purchase Requests	> 840,000
People who "Telework"	11.0 million

Source: Geoffrey Wheelwright, "Electronic Commerce," FINANCIAL TIMES, 1/7/98, p. 15.

Section 3: Current Federal Efforts to Reduce VMT

The overwhelming majority of federal efforts to reduce VMT are being performed by the Department of Transportation. Table 6 provides a break-down of federal spending but the different agencies. (Most of ISTEA spending is on road construction and maintenance, but HOV lanes and pedestrian/biking projects are eligible for funding). It shows that DOT is spending billions on efforts affecting VMT, while EPA and DOE are spending less than $1 million each.

Table 6: Federal Programs Affecting VMT

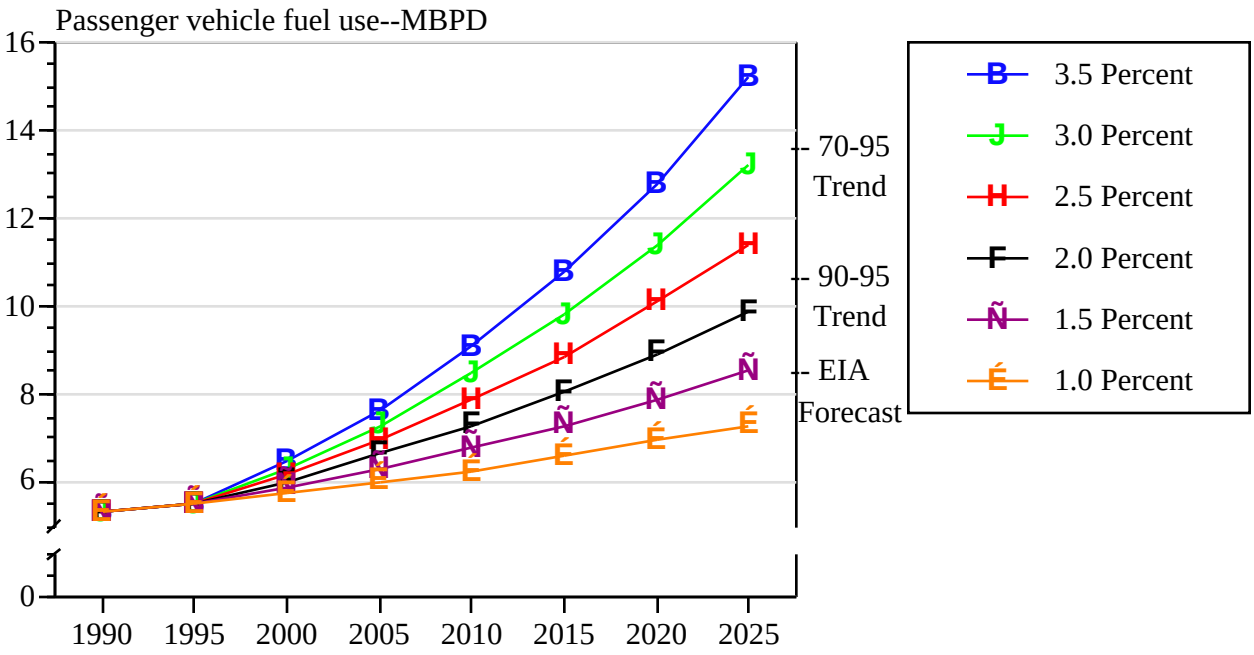
Federal Program	Annual Budget ($MM)
DOT--CMAQ (Federal Highway Administration)	$1,000
DOT--ISTEA (Federal Highway Administration)	$26,000
DOT--Mass Transit (Federal Transit Administration)	$4,300
DOT--AMTRAK (Federal Railroad Administration)	$900
EPA--Voluntary Programs	}
DOE-- Center of Excellence for Sustainable Develop.	} < $5m
DOE--Location Efficient Mortgages	}

The Clean Air Act Amendments of 1990 (CAAA) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) are driving current federal efforts at the Department of Transportation (DOT) and the Environmental Protection Agency (EPA). DOT is involved in VMT reduction by requiring local transportation plans to conform with CAAA requirements; administering the Congestion, Mitigation, and Air Quality (CMAQ) Program; subsidizing mass transit projects; and subsidizing AMTRAK. DOT's major authorizing bill, ISTEA, is up for re-authorization and may include funds to implement intelligent transportation systems (ITS). EPA is involved with VMT reduction primarily through policy actions such as establishing guidelines for meeting CAAA requirements; providing guidance on TCMs (as defined in the CAAA); and implementing the Employee Commute Options (ECO) program. DOE, like EPA, is involved in VMT reductions efforts only in a peripheral manner. DOE is helping fund a case study on location efficient mortgages and addresses VMT somewhat through studies performed by its policy office; projects funded by the Center of Excellence for Sustainable Development; and efforts within its Clean Cities program.

Section 4: Conclusion

The level of growth in VMT matters enormously in estimating future transportation fuel use. Figure 13 shows projected light vehicle fuel use for varying VMT growth rates. In 2025, oil use is only about 7 MBPD if the growth rate is 1% per year, as opposed to over 15 MBPD if the growth rate is 3.5% per year.

Figure 13: Projected Light Vehicle Fuel Used for Various VMT Growth Rates



Note: Estimates were calculated using the "Cartalk" model developed by Lew Fulton for use by the "Policy Dialogue Advisory Committee to Develop Options for Reducing Greenhouse Gas Emissions from Personal Motor Vehicles" in 1995. MBPD = million barrels of oil per day.

Whether VMT growth is closer to 1% or 3.5% depends on future travel trends, some of which are impossible to forecast. AEO 98 forecasts a growth rate of about 1.5% per year, but has a history of underestimating VMT growth. Trends that favor a VMT growth rate closer to 1.0% are:

-- Relatively low population growth,
-- Aging of the population,
-- Exponential growth in the use of the internet.

Trends that favor a VMT growth rate closer to 3.5% are:

-- Increasing VMT levels by the elderly, women, and minorities,
-- Population shifts to less populated areas (thus less densely populated) such as the South and West,
-- Relatively low cost of driving with low oil prices.

Saving fuel by lowering VMT growth can be compared to saving fuel by increasing vehicle fuel economy. Table 7 and Figure 14 illustrate potential savings in fuel use in 2010 and 2020 for selected fuel economy and VMT scenarios. The fuel economy scenarios are for substantial market penetration of "2X Vehicles" and "3X Vehicles." "2X Vehicles" refers to doubling fuel economy

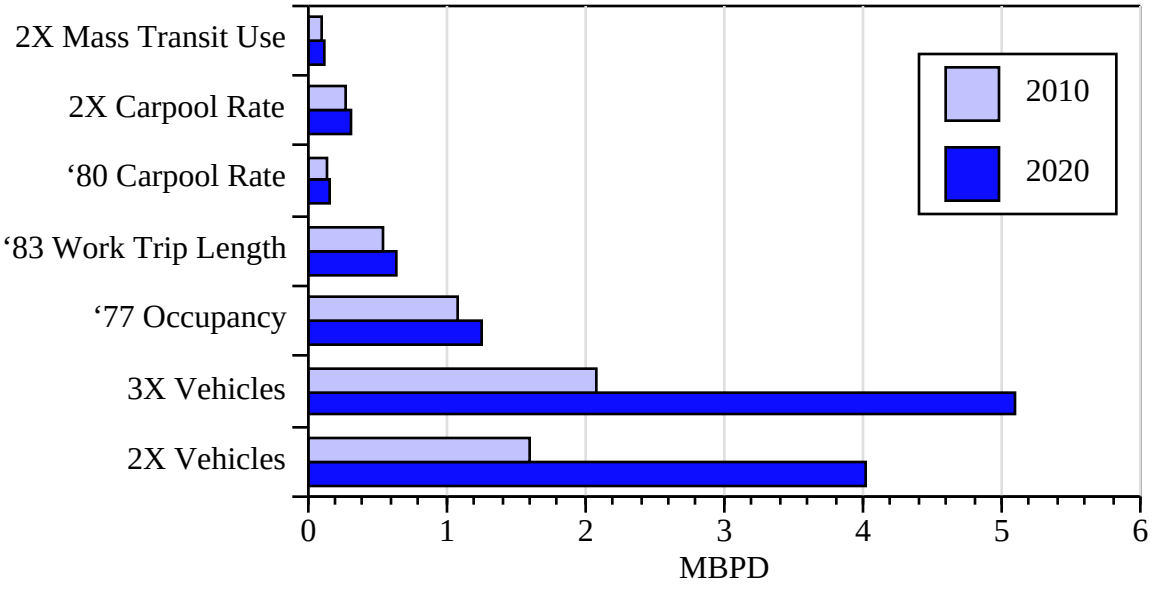
of light vehicles (1995 CAFE being the baseline) and "3X Vehicles" refers to tripling fuel economy of light vehicles. The fuel economy scenarios assume ~50% personal vehicle stock penetration in 2010 and ~100% personal vehicle stock penetration in 2020 of highly efficient vehicles. The VMT options were derived by assuming that in the future key VMT factors would be like they were in the past or double what they are now. For example, the "'77 Occupancy" scenario simply assumes that future vehicle occupancy rates will be like they were in 1977 instead of 1995. The ratio of rates between 1995 and 1977 is used to estimate a fuels savings.

Table 7: Comparison of Potential Fuel Savings from Fuel Economy Improvements and VMT Reduction (MBPD)

Option	2010	2020	Calculation
2X Vehicles	1.61	4.02	Cartalk Model
3X Vehicles	2.08	5.1	Cartalk Model
'77 Occupancy	1.08	1.26	(1-(1.59/1.9))*BASEOIL
'83 Work Trip Length	0.55	0.64	(1-(8.5/11.6))*.311*BASEOIL
'80 Carpool Rate	0.14	0.17	(.20-.13)*.311*BASEOIL
2X Carpool Rate	0.27	0.31	0.13*0.311*BASEOIL
2X Mass Transit Use	0.11	0.13	0.053*0.311*BASEOIL

Note: Baseline fuels use (BASEOIL) is 6.6 MBPD in 2010 and 7.7 MBPD in 2020. The number 0.311 in the equations above reflects the percent of VMT that is travel to and from work (commuting).

Figure 14: Comparison of Potential Fuel Savings from Fuel Economy Improvements and VMT Reduction (MBPD)



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